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THE STATISTICS OF THE COPPER MINES OF CORNWALL.

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[*Read before the Statistical Society of London, March* 19, 1838.]

It may possibly render the accompanying Tables more intelligible if I give a slight sketch of the progress of the Copper Mines of Cornwall, since they have assumed an important station in the commercial wealth of the country; and this requires no distant retrospect. In a report on the state of the copper mines, drawn up in the year 1799, it is stated that " it was not until the latter end of the last century that copper ore was first discovered in Great Britain, and that was in working the tin mines of Cornwall, which have been wrought time immemorial." I believe that this statement is not strictly correct, but that copper, probably the produce of mines, more especially wrought for tin, was known at an early period, though in quantities by no means answering the demand even of those times. Hence the prohibition of its export in the time of Henry VIII. Carew says—" Copper is found in sundrie places, but to what gain to the searchers I have not been curious to inquire, nor they hasty to reveal; for of one mine of which I took view, the ore was shipped to be refined in Wales, either to save cost in the fuel, or to conceal the profit." Borlase, whose work was published in 1758, says—The application of the Cornish to work the copper mines is not so old as the present generation." He says, " that, about forty years prior to that time, a certain Mr. Costar, who was particularly knowing in mechanics and hydraulics invented a new water-engine, by which he drained some considerable mines with success." " Here," he says, " we may date the advance of the price of copper, and the improvement of the copper mines." Mr. Carne (" Geological Transactions of Cornwall," vol. iii.), after adducing proof that copper only to a limited extent could have been raised in any part of England at an earlier period, and that no records are extant of copper raised in Cornwall previous to the latter part of the sixteenth century, concludes his argument with these remarks:—" On the whole, it appears probable, that previous to A. D. 1700, the copper ore produced in Cornwall was principally, if not wholly, from the tin mines, or at least from mines originally worked for tin; and although it is by no means correct that it was not till the latter end of the seventeenth century, that copper ore was first discovered in Great Britain, as was stated to a committee of the House of Commons in 1799, yet that appears to have been the period when mines were first set at work purposely for copper. This is corroborated by the fact, that, although a charter for making brass was granted as early as 1595, it was not until 1691 that a charter was granted (to Sir Joseph Hearne and others) for refining and purifying copper. Another circumstance which tends to the same conclusion, is, that the copper money of Great Britain was not coined from British copper till 1717." It is clear that the steam-engine could not have been known as an instrument for drawing water, when the water-engine of Mr. Costar effected so great a change. It is probable, therefore, that the passage of Borlase, which refers to Costar's engine, was written some years previous to the publication of his book; for Mr. Carne states that the first steam-engine in Cornwall was erected on a mine which was worked from 1710 to 1714. The second steam-engine was erected at Wheal Fortune, in Ludgvan, in the year 1720; and, imperfect as that instrument probably was, its importance was quickly felt. I have a memorial from the county of Cornwall, the date of which must have been before 1730, praying that facilities might be given for the importation of coals, on account of the distressed state of the mines and the necessity of working them to a greater depth. It is curious that the plea made use of is, that the old mines were nearly wrought out, and that the whole county had been so completely searched, that there was no hope whatever that any new lodes would be discovered. The existence, therefore, of the Cornish copper mines appeared at that time to depend on the application of the new power brought into action by steam. Thus it seems, that the discovery of the power of the steam-engine in drawing water was almost coincident with the rise of the copper mines on a great scale; and its history is parallel with that of the mines themselves throughout their course.

The following observations are, in substance, taken from a paper by Mr. Davies Gilbert in the "Philosophical Transactions" for 1830.

Mr. Newcomen's engines were brought into Cornwall early in the last century, where they immediately superseded the laborious method of drawing water by human exertions, applied through the simple medium of a chain-pump, similar in construction to those at present used on board large ships. In 1769 Mr. Watt obtained a patent, which was afterwards extended to 1800; and, as in his contracts he reserved for himself a portion of the saving to be effected by the use of his invention, it became necessary to institute an enquiry into the efficiency of the engines then in existence, that the comparison might thenceforth be made. At that time the mode of computation now in use was not known, but the elements of the calculation are preserved; and, when reduced according to the present form, they give an average duty or efficiency of somewhat more than 7,000,000. To make this intelligible, the formula of the calculation must be given, which is as follows:—

"A pound avoirdupois, lifted one foot high, is assumed as the dynamic unit. The product of pounds, and the number of feet through which they are lifted in a given time, divided by the number of bushels of coal consumed in the same interval, give what is now termed the duty of an engine."

In the year 1793 an account was taken of the work performed by 17 engines on Mr. Watt's construction, and the duty was found to be 19,569,000 lbs. of water raised one foot high by the consumption of a bushel of coal. In 1800, Mr. Watt's patent expired; and in 1813, the system of regular returns from the principal engines, in what is called the duty paper, commenced. The following Table, marked I., is constructed from these papers.

I.—*A Table of the Duty performed by Steam Engines in Cornwall, shewing the Average Duty of the whole for each Year, and also the Average Duty of the best Engine.*

Years.	Approximate No. of Engines reported.	Average Duty of the whole.	Average Duty of the best Engine.	Years.	Approximate No. of Engines reported.	Average Duty of the whole.	Average Duty of the best Engine.
1813	24	19,456,000	26,400,000	1826	48	30,486,630	45,200,000
1814	29	20,534,232	32,000,000	1827	47	32,100,000	59,700,000
1815	35	20,526,160	28,700,000	1828	54	37,100,000	76,763,000
1816	32	22,907,110	32,400,000	1829	54	40,910,000	76,100,000
1817	31	26,502,259	41,600,000	1830	55	43,108,747	76,885,516
1818	32	25,433,783	39,300,000	1831	58	43,350,555	71,087,000
1819	37	26,252,620	40,000,000	1832	59	45,040,221	85,045,000
1820	37	28,736,398	41,300,000	1833	56	46,626,558	73,335,000
1821	39	28,223,382	42,800,000	1834	52	47,837,064	90,920,000
1822	45	28,887,216	42,500,000	1835	51	48,210,293	91,672,211
1823	45	28,156,162	42,122,000	1836	61	46,646,250	85,399,000
1824	45	28,326,140	43,500,000	1837	58	47,087,374	87,212,000
1825	50	32,000,741	45,400,000				

Respecting the methods of this progressive improvement, Mr. Gilbert makes the following observations:—"The principles, and even the mechanism of Mr. Watt's engine, have remained unaltered since their first introduction, unless a change in the precise periods of opening and closing the valves could be considered a variation. But to such an extent has the economy of fuel been carried by the use of steam at a high degree of temperature, and consequently of pressure, usually from 50 to 60 inches of mercury above the atmosphere; by extending the expansive action to $\frac{2}{3}$ and sometimes $\frac{3}{4}$ of the whole descent of the piston; by making small fire-places with sharper draughts in iron tubes surrounded by the water of the boiler*;" by more effectually preventing the escape of heat; by enlarging the engines themselves; and perhaps by executing the work with superior accuracy, that in the monthly Return of Duty performed in Cornwall, by the steam-engines in December, 1829, the best engine, with a cylinder of 80 inches, did 75,628,000, exceeding the duty in 1795, in the proportion of 27 to 7.

With respect to the effect produced in the mines by this progressive improvement of the steam-engine, two kinds of statement have been exhibited. The first, shewing cases of mines previously abandoned, but resumed with profit and effect: and the second, where the increase of power and saving of fuel have rendered profitable, undertakings which, though still continued, were sinking under the pressure of their expenses, and appeared to have reached the limit to which they could penetrate.

Mr. Taylor cites many instances illustrative of each case; and it is impossible to read these without being impressed with the conviction that the prosperity of the Cornish mines has been maintained by the constantly increasing power of the steam-engine. In fact, new powers have been developed almost from year to year, as the old methods became exhausted, and the depths attainable were worked out. Were there a limit to human ingenuity, the inference from these facts would be alarming.

Another element of power in mining has been the great improvements lately made in the art of smelting. Ores producing only three or four per cent. of metal are now brought to sale and smelted, and, in some extraordinary cases, even when the produce is still smaller.

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* M. Jars, in 1765, speaks of pipes of smoke passing through the water in the boiler in Cornish engines.

The standard is the price of cake copper, minus a fixed sum per ton of ore on the average of the ores sold at the ticketting. This sum was originally the estimated cost of smelting. About thirty years ago it was considered too small, and accordingly cake copper sold in the market at from 5*l.* to 8*l.* per ton more than the standard; but of late years cake copper has been sold at from 18*l.* to 20*l.* less than the standard—the difference being a direct and clear gain to the miner. According to the present produce of the county, the amount of saving may be estimated at nearly 300,000*l.* a year. M. Jars, in 1765, says, "No copper ore is sold under 30*s.* a ton—that is to say, ores which are not saleable at this price are not worth the expense of smelting; there are, however, some ores which sell as high as 60*l.*, but never above this price." At the last ticketting (Feb. 1838), the lowest price was 1*l.* 2*s.* 6*d.*, and the highest 14*l.* 5*s.* 6*d.*

The following Table (No. II.) will shew the average produce of the ores smelted from all the mines of Cornwall, for sixty years, and at decennial intervals.

II.—*Produce per Cent. of Ores, in Decennial Periods, from* 1771 *to* 1837.

Years.	Tons of Ore.	Tons of Copper.	Produce per Cent.	Years.	Tons of Ore.	Tons of Copper.	Produce per Cent.
1771	27,896	3,347	12	1801 to 1810	67,532	6,059	9
1781	28,749	3,450	12	1811 to 1820	78,560	6,602	$8\frac{1}{4}$
1791		Records lost.		1821 to 1830	114,040	9,143	8
1800	55,981	5,187	$9\frac{6}{10}$	1831 to 1837	142,785	11,637	$8\frac{1}{8}$

It seems reasonable to conclude that the quality of the ores found cannot have varied in the degree marked by the average produce; and that the decline has depended rather on the produce of the ores brought to the smelting-houses being always lower, as the improvement in smelting advanced. M. Jars mentions an attempt to smelt ores in the furnace of the steam-engine while heating the water in the boiler, which for obvious reasons must have failed.

Mr. Carne observes—"Another economical improvement has been made by the application of the steam-engine to draw the ore and rubbish out of the mine. These were formerly brought to the surface by the labour of horses. The difference of the expense of steam and horses for this purpose is nearly fifty per cent. From the increased number and depth of the mines, this work could not possibly be performed at present by horses." Héron de Villefosse, who probably wrote about the year 1810, says "there were then from twelve to fifteen such engines in use throughout the country." The number, of course, is now greatly increased, and it is in contemplation to apply the same machinery to raise the miners from their work, whereby a great saving will be effected in the time and powers of the men, and consequently an increase in the quantity of work, for which the same amount of wages will be paid. At the Consolidated Mines, 826 men and boys are now working at and below the 100-fathom level, at an average depth of 229 fathoms. The aggregate ascent, therefore, on which bodily effort is day by day expended, is about 380,000 yards, or nearly eighty times the height of Mont Blanc. Mr. Hawkins (in vol. iv. of the "Transactions of the Cornish Geological Society") points out a further source from which the miners have obtained power over the difficulties in the way of their progress. He says —"A step no less important was gained by the introduction of the art of blasting rocks. This I believe, cannot be traced in this country higher than the beginning of the last century, which is a century later than the period of its invention in Germany. It was, most probably, first introduced into this kingdom by Prince Rupert, who must have been well acquainted with the mode of working mines in Germany, and for some years directed the Society of the Mines Royal." It is impossible to calculate the profits of adventurers in the Cornish mines, taken in long periods; but I here insert a Table, from the report above alluded to, shewing the gross amount of money received for ores, and the cost in labour and materials, for seven years, ending with the date of that report, 1799.

III.—*General State of the Copper Mines in Cornwall, for Seven Years, ending* 31*st December*, 1798.

Years.	Adventurers' amount of Ore.			Labour.			Materials.			Total Cost.			Profit.			Loss.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
1792	279,331	15	10	150,824	12	3	91,361	6	4	251,865	19	11	27,465	15	11	. .		
1793	283,853	12	11	176,333	2	7	110,122	15	2	294,226	15	0	. .			10,373	2	1
1794	293,853	10	11	179,187	15	5	111,093	19	11	294,775	19	5	. .			922	8	6
1795	305,320	6	9	189,713	10	1	111,640	2	3	312,047	7	5	. .			6,727	0	8
1796	348,836	12	11	201,995	18	6	105,925	12	1	324,897	18	4	23,938	14	7	. .		
1797	320,606	15	9	189,821	15	11	109,008	7	3	309,060	14	10	11,546	0	11	. .		
1798	405,488	15	9	253,601	12	3	146,253	16	3	408,248	7	11	. .			2,759	12	2
	2,237,291	10	10	1,341,478	7	0	785,405	19	3	2,195,123	2	10	62,950	11	5	20,782	3	5
	Net profit for seven years . . . £42,168. 8*s.* 0*d.*																	

The yearly value of ores in this Table does not agree with the amounts in another Table, which I shall afterwards give, of the produce of the copper mines since 1770, because, in the former, the portion of ores paid to the landlords as dues is not included.—At this time Mr. Vivian, who gave evidence before the Committee, divided the mines then at work into three classes, and computed the results of their cost and produce for the six months preceding as follows :—The first class comprised the old deep mines, producing more than half the copper then raised in Cornwall; they are ten in number. The second class included profitable mines, producing three-eighths of all the copper; they are seven in number. The third class consisted of forty-two comparatively new mines, carried on in the hope of future profit.—*See* Table IV.

IV.—*The three Classes of Mines, referred to by Mr. Vivian, are tabulated in this form.*

	Copper.	Ore Sold.	Current Cost.	Profit.	Loss.	Capital in Mines.	Loss unrecovered.
	Tons.	Tons.	£.	£.	£.	£.	£.
First Class . .	1,388	115,121	116,209	3,153	4,240	102,489	69,181
Second Class .	1,083	86,377	49,311	37,066	..	66,813	5,483
Third Class. .	141	14,517	31,813	. .	17,295	16,267	90,124
	2,613	216,017	197,333	40,219	21,536	185,569	164,789

I believe, however, that the accuracy of these Tables cannot be entirely relied upon—many sources of error exist, and some omissions; and it must be borne in mind that the Tables were constructed to meet an attempt by the manufacturers of Birmingham to fix a maximum price for copper. The rate of gaining to losing mines is stated to have been 11 to 63; and Mr. Vivian computed the number of working men engaged in copper mines at from 5000 to 6000; the women and boys being 4000 or 5000—making, with their families, between 30,000 and 40,000 souls. Birmingham at this time consumed annually from 1000 to 1500 tons of copper.

Pryce states, that from 1726 to 1735 the average annual produce of the county of Cornwall was, in ores, 6000 tons, producing probably 800 to 1000 tons of copper; and that in 1770, the quantity of ore had increased to 27,000 tons, which yielded 3200 tons of copper.

The Tables marked V. and VI. shew the produce of the county in copper and money since 1770.

V.—*An Account of the Annual Produce of the Copper Mines of Cornwall, from the year* 1771 *to* 1800 *inclusive.*

Years.	Tons of Ore.	Tons of Copper.	Value.	Standard.	Years.	Tons of Ore.	Tons of Copper.	Value.	Standard.
			£.	£.				£.	£.
1771	27,896	3,347	189,609	81	1786	39,895	4,787	237,237	75
1772	27,965	3,356	189,505	81	1787	38,047	..	190,738	..
1773	27,663	3,320	148,431	70	1788	31,541	..	150,303	..
1774	30,254	3,630	162,000	68	1789	33,281	..	184,382	..
1775	29,966	3,596	192,000	78	1790	..	..	..	..
1776	29,433	3,532	191,590	79	1791	..	..	..	..
1777	28,216	3,386	177,000	77	1792	..	..	..	..
1778	24,706	2,965	140,536	72	1793	..	..	..	..
1779	31,115	3,734	180,906	73	1794	42,816	..	320,875	..
1780	24,433	2,932	171,231	83	1795	43,589	..	326,189	..
1781	28,749	3,450	178,789	77	1796	43,313	4,950	356,564	..
1782	28,122	3,375	152,434	70	1797	47,909	5,210	377,838	..
1783	35,799	4,296	219,937	76	1798	51,358	5,600	422,633	..
1784	36,601	4,392	209,132	72	1799	51,273	4,923	469,664	121
1785	36,959	4,434	205,451	71					

VI.—*An Account of the Copper produced from the Mines in Cornwall, from* 1800 *to* 1837.

Years.	Quantity of Ore.	Copper.	Value of Ore.	Produce	Standard		Years.	Quantity of Ore.	Copper.	Value of Ore.	Produce	Standard	
	Tons.	Tons.	£.		£.	s.		Tons.	Tons.	£.		£.	s.
1800	55,981	5,187	550,925	9·25	133	3	1819	88,736	6,804	623,595	7·625	127	10
1801	56,611	5,267	476,313	9·25	117	5	1820	91,473	7,508	602,441	8·125	113	15
1802	53,937	5,228	445,094	9·625	110	18	1821	98,426	8,514	605,968	8·625	103	0
1803	60,566	5,615	533,910	9·25	122	0	1822	104,523	9,140	663,085	8·75	104	0
1804	64,637	5,374	507,840	8·375	136	5	1823	95,750	7,927	608,033	8·25	109	18
1805	78,452	6,234	862,410	7·875	169	16	1824	99,700	7,823	587,178	7·875	110	0
1806	79,269	6,863	730,845	8·625	138	5	1825	107,454	8,226	726,353	7·625	124	4
1807	71,694	6,716	609,002	9·375	120	0	1826	117,308	9,026	788,971	7·625	123	3
1808	67,867	6,795	495,303	10·	100	7	1827	126,710	10,311	745,178	8·125	106	1
1809	76,245	6,821	770,028	8·875	143	12	1828	130,366	9,921	756,174	7·625	112	7
1810	66,048	5,682	570,035	8·5	132	5	1829	124,502	9,656	717,334	7·75	109	14
1811	66,786	6,141	556,723	9·125	120	12	1830	135,665	10,890	784,000	8·	106	0
1812	71,547	6,720	549,665	9·375	111	0	1831	146,502	12,218	817,740	8 375	99	18
1813	74,047	6,918	594,345	9·25	115	7	1832	139,057	12,099	835,812	8·75	104	14
1814	74,322	6,369	627,501	8·5	130	12	1833	138,300	11,185	858,708	8·	110	0
1815	78,483	6,525	552,813	8·25	117	16	1834	143,296	11,224	887,902	7·75	114	4
1816	77,334	6,697	447,959	8·625	98	13	1835	150,607	12,271	896,401	8·125	106	11
1817	76,701	6,498	494,010	8·5	108	10	1836	140,981	11,639	957,752	8·25	115	12
1818	86,174	6,849	686,005	7·875	134	15	1837	140,753	10,823	908,613	7·625	119	5

For the reasons above stated, the rate of wages in copper mines cannot be determined previously to the commencement of the last century; but an old manuscript book, entitled the "Bailiff of Blackmore," speaks of the wages of tinners; and they may be taken as the rate of wages amongst the miners generally. The writer says—"the most part of the workers of the black tyn and spaliers are very poor men, as no doubt that occupation can never make them rich; and chiefly such tyn workers as have no bargains, but only trust to their wages, although they have never so rich a tyn worke; for they have no profit of their tyn, if they be hyred men, saving only their wages, for their masters have their tyn. Now, if they should chance to be farmers themselves, and their worke fall bad, then run they most chiefly in their masters' debts, and likely to increase more and more, rather than to requite any part thereof; for of these two choyses, to be a hyred man or a farmer—the one is a certaintie, and the other an uncertaintie. The farmer knoweth not how his worke will doe, until tyme that he hath proved it, and must needs live in hope all the yere, which for the most part deceiveth him (as the saying is), *Qui spe vivit, nusquam agit vitam.* Then on the other part, concerning the wages of the tynner working his dole, the common wages is but iij*l.*, or five marke, a dole's working for a yere to the uttermost. Yet must the worker find himself meat and drinke, which is little above ij*d.* a day. This poor man, happily, hath a wife and iiij or v small children to care for, which all depend upon his getting—whereas all his wages is not able to buy himself bread. Then, to pass over the poore man's house-rent, cloathing for his poore wife and children, besides divers other charges daily growing upon them! O, God, how can this poore man prosper. Yet this much, I confess, of the wealthiest of tynners, which happily work together in one tynworke with the poore man, they are very charitable and merciful towards their poore fellow-workers; for at dinner time, when they sit down together beside their tynworke, in a little lodge made up with turfes covered with straw, and made about with handsome benches to sit upon, then every tynner bringeth forth out of his scrip or tyn bagges, his victuals, his bread, his bottle of drinke, as the rich tynners will lack none of them being left in number; then is their charitie so great, that if one, two, or three, or else more poore men sit among them, having neither bread, drinke, or other repast, there is not one amongst all the rest but will distribute at the largest sorte with their poore workfellows which have nothing—so that, in the end, this poore man, having nothing to relieve him at the worke, shall in fine, be better furnished of bread, cheese, butter, beefe, porke, bacon, than all the richest sorte," &c.

The foregoing extract, which is curious not merely with reference to the amount of wages paid, but also to the habits of the miners and the articles of their food, describes the state of the tinners in the time of Queen Elizabeth, I believe near the commencement of her reign.

In the debate on monopolies, in 1601, Sir Walter Raleigh, then Lord Warden of the Stannaries, used these words:—"Now I will tell you, that before the granting of my patent, whether the tin was but at 17*s.*, and so upwards to 50*s.* a cwt., yet the poor workman never had but two shillings a week, finding himself. But, since my patent, whoever will work, be tin at what price soever it may, they have 4*s.* a week truly paid; there is no poor that will work there but may, and have, that wages."—Sir W. Raleigh's patent was in 1585; hence it appears that wages had been doubled since the former period alluded to by Sir Walter Raleigh, and quadrupled since the time of the "Bailiff of Blackmore."

Carew observes—"The hirelings stand at a certain wages, either by the day, which may be about 8*d*., or for the year, being between 4 and 6 pound, as their deserving can drive the bargain; at both which rates they must find themselves." I can make nothing of this statement, because Carew wrote nearly at the time when Sir Walter Raleigh spoke, and he gives the rate of wages at double the amount stated by Sir W. Raleigh, who must have known the truth, as being personally concerned. Moreover, "4 or 6 pound for the year" is only 3*d*. or 4½*d*. per day, and not 8*d*., as stated by Carew. Tomkin, in his note on the above, describes the state of the working miner, in 1739, in the following terms:—"The common way of agreeing with the workmen is by the month, which is from 20*s*. to 27*s*. to the best workman; besides which they have stemmings, as they call it, in all the great works, for which they have so much a stem, as they can agree for; that is, for so many hours beyond their ordinary allotment, either drawing water, work, or attle, and all the tools, new setting, and steeling them, materials, &c., are found and provided at the charge of the owners. The captains have 30*s*., 40*s*. or 50*s*., nay, sometimes 4*l*. per month. The binders likewise, that is, the carpenters who take care to secure the shafts, adits, and workings, by laying beams, dams, planks, &c., have considerable wages, few less than 40*s*. or 50*s*. per month." The tools in use in the year 1671 are thus described in a paper in the "Philosophical Transactions" of that year:—"A bele, or Cornish tubber, of double points, of 8 or 10 lbs. weight, sharpened at both ends with steel, and holed in the middle. It may last in a hard country half a year, but must be new pointed every fortnight at least. A sledge (flat-headed) from 10 to 20 lbs., will last seven years, but must be new ordered once a quarter. Gads, or wedges, 2 lbs. weight, and four inches square, and steeled at the point, will last a week, but must be sharpened every two or three days." Ladders and wheel-barrows.

The above extracts relate to a period extending from the commencement of the reign of Queen Elizabeth to the year 1740. During the whole of this time, though the price of wheat was occasionally much elevated or depressed, the quinquennial averages generally ranged between 32*s*. and 45*s*. per quarter, and were lower at the latter part than at the commencement of the period. Thus the gradual rise in the wages of the miners may be taken as an indication of improvement in their condition. —*See* Table VII.

VII.—*Price of a Quarter of Wheat on the Average of Five Years.*

Years.	Shillings.	Years.	Shillings.	Years.	Shillings.	Years.	Shillings.
1565	42	1610	34	1655	41	1700	50
1570	42	1615	34	1660	40	1705	30
1575	45	1620	34	1665	46	1710	33
1580	43	1625	35	1670	32	1715	44
1585	48	1630	34	1675	38	1720	33
1590	42	1635	45	1680	42	1725	29
1595	46	1640	34	1685	35	1730	39
1600	64	1645	40	1690	27	1735	25
1605	27	1650	53	1695	40	1740	32

The present state of wages near Redruth, St. Austell, and Penzance (the three principal *foci* of mining), is given in Table VIII.; and it is worthy of remark, that in places distant from each other only a few miles, the rate of wages sometimes differs largely, and for long periods. I can explain this only by the known fact of the attachment of the Cornish miner to his own home.

The returns in the Tables VIII. IX. and X. relate to three different classes of labourers, and the three modes by which their wages are paid:—

1. *Daily Labourers.*—The work on the surface is, to a great extent, done for daily wages, which are regulated by the circumstances of the times, as in other callings.
2. *Tutwork men*, who are paid by the piece, and contract for their work by the fathom.
3. *Tributers*, the most considerable class.

VIII.—*Rate of Wages per Month in* 1837.

	West of Penzance.		Midland District, &c.		St. Austell District, &c.		Average.			
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Tributers . . .	47	6	68	0	59	0	58	2	51	6
Tutworkmen . .	45	0	57	2	59	0	53	8		
Day Labourers . .	42	0	41	0	45	0	42	8		

The numbers of each class are nearly equal.

IX.—*Persons employed in the Consolidated Mines and in Fowey Consols.*

	Consolidated Mines.	Fowey Consols.
Agents . . .	28	20
Tributers . . .	392	320
Tutworkmen . . .	441	420
Boys underground . .	109	..
Day Labourers ditto .	..	110
Day Labourers on surface	335	187
Boys on surface . .	327	315
Women and Girls . .	755	308
Total . .	2,387	1,680

X.—*Scale of Wages paid at the Consolidated Mines for* 1836.

	Per Month. £.	*s.*	*d.*
Tutworkmen	3	11	6
Tributers	4	5	0
Surface Labourers	2	6	0
Women and Girls above 17 . .	0	18	0
Girls from 14 to 17	0	15	0
Girls from 12 to 14	0	12	0
Girls from 9 to 12	0	8	0
Boys above 12	0	13	0
Boys below 12	0	9	0

Mr. John Taylor, in a lecture delivered to the Society of Arts in March, 1837, describes the present customs in the following manner—"There are two kinds of contract entered into with the men, by one of which they are paid for cutting through rocks generally unproductive of ore, or where the procuring it is not the principal object, and these payments are according to the measured quantity excavated. The other, which is called 'tribute,' is an agreement by which the men working on ore ground are to be remunerated by a portion of the produce, rendered on the surface in a marketable state. Of the first kind of contract I shall say little, because there is nothing essentially different from bargains similarly made in all kinds of work. But I may remark on one feature common to all the agreements made with the men in the Cornish mines; which is, that they are for short and regular periods, that is to say, for one or two months, and that the mode of letting is by the kind of auction alluded to by Mr. Babbage, by which every bargain is open to full and fair competition. The rate of wages, therefore, regulates itself by the circumstances that ought to control it—the demand for labour. No one has heard of disagreements between the Cornish miners and their employers; no combinations or unions on the one side or on the other exist, nor have turn-outs or strikes been attempted or contemplated."

Mr. Babbage says of this system, "that no other mode of payment affords to the workmen a measure of success, so directly proportioned to the industry, the integrity, and the talent which they exert." I have only to add, that the bidding is usually concluded by throwing up a stone; and the man who bids last, before the stone touches the ground, is master of the work. A very full account of these auctions is given in the *Mining Journal* for June 11, 1836.

With respect to the mode in which the work in mines is set and bargained for, I find the following account in a paper, which was read before the Académie Royale des Sciences, at Paris, in 1765; it is by M. Jars, who seems to relate from personal observation, and it has been published in the third volume of his "Voyages Metallurgiques." I give it because it accords very nearly with the customs now in use, and shews that the system on which Mr. Babbage has bestowed his just commendation is of no recent date. He says, "The established custom in all the mines of this province (Cornwall), is to set the work to be done to certain contractors, who, by themselves or by labourers employed by them, extract the ores. The day being fixed beforehand, those who are interested in the mine, or their agents, assemble, and the contractors make their offers, bidding downwards (*en rabais*). The extent of each bargain is called a 'pitch,' and is usually fifteen, twenty, or twenty-four fathoms of level (the distance of one winze from another), and seven fathoms in depth. The period of each bargain is always four months, and the workmen provide themselves with all tools, candles, and gunpowder. The contract is determined by a portion of the minerals extracted, that is to say, the contractors receive one-third, one-fourth, one-fifth, &c. of the value raised, according to the terms of the agreement. In the tin mines they receive the portion in ore, but in the copper mines in money. From the nature of the bargain, there is evidently a great risk to the contractors, who sometimes make a profit, and at others incur loss. But it is otherwise with the adventurers, who, whatever may be the bargain, make some profit on their portion of the ore. Therefore it is, that though the contractors have a right to continue their work for four months, and the adventurers cannot break the bargain during that time, still, if the work should turn out ill, the contractors, after having worked for a month, are at liberty to relinquish their pitch, on the payment of 1*l.* sterling for each workman in their service. This custom is generally observed."

M. Jars thus describes the sale of ores at the tickettings—"The adventurers or their agents dine together at the expense of the Lord (*au frais du seigneur*). While they sit round the table, each person gives in his ticket, offering a certain sum, from 3*l.* to 6*l.*, for so many tons of ore.

The tickets are then read with a loud voice, and the persons present make a note of the prices offered. It is impossible to conceive a better or fairer mode of sale, and the bargains thus made are never disputed." This form of proceeding at the sales, and the above-described method of setting the work to the men, are characteristic of the Cornish mines; and we have the authority of M. Jars to prove, that the customs in use above seventy years ago have not very materially varied up to the present day.

It may seem strange that I should refer to foreign authors respecting these customs; but, in truth, people do not describe what is always before their eyes, and known to their neighbours as well as themselves. A stranger sees and records what a native presumes to be notorious.

Many of the following Tables are founded on the transactions of two mines only, but they are very important mines, producing about one quarter of the copper of the county. I have thought that to give an insight into the system of working the Cornish copper mines, the various interests at work, and their combined effect on the population and wealth of the county, no better illustration could be adopted than one which partakes so much of the life and reality of a portrait; moreover, this method has enabled me with some sort of probability to deduce relatively the value and amount of things respecting which it is quite impossible to obtain an actual return. With respect to wages, for instance, no industry would have enabled me to collect the actual sum; but I think it may, in some measure, be inferred from a comparison between the wages paid and the value of the ores returned by these two mines, assuming the same relation to exist between the total value of ores and labour throughout the county. Thus, I imagine that the total wages paid in the copper mines of Cornwall, in the year 1836, could not be far from 482,000*l.*—*See* Table XI.

XI.—*Ratio of Wages and Salaries to Gross Expenditure and Gross Receipt from Ores, in* 1836.

MINES.	Ratio of Wages and Salaries to	
	Gross Expenditure.	Gross Receipt from Ores.
Consolidated Mines . .	·673 to 1	·470 to 1
Fowey Consols . . .	·777 to 1	·551 to 1
Average . .	·725 to 1	·510 to 1

The value of ores raised in these mines being 243,712*l.*, and the wages and salaries 122,786*l.*; and the total value of copper ores in the county, in the year 1836, having been 957,752*l.*; the amount of wages and salaries paid in all the copper-mines of Cornwall, according to the same ratio, will have been 482,116*l.*

I have analysed the accounts of these two mines, and have given a statement of their expenditure in detail; of the quantity and value of each kind of material consumed; and of the proportional cost of each to the other items, and to the gross expense of working the mine. For this purpose I have taken the total cost as unity, and have given to each item its value by a decimal fraction (Table XII).

XII.—*Quantity and Value of Coals, Iron, Debenture Timber, and Gunpowder, consumed in* 1836, *in the Consolidated Mines and Fowey Consols; and Ratio of the same to the Gross Expenditure (except dues).*

		Consolidated Mines.			Fowey Consols.		
		Quantity.	Value.	Ratio to Unity.	Quantity.	Value.	Ratio to Unity.
			£.			£.	
Gross Expenditure		..	102,007	..	..	69,419	..
Coals	Tons	11,817	11,619	·1139	1,301	1,280	* ·0185
Iron, Steel, and Castings	£	..	3,315	·0324	..	3,065	·0441
Debenture Timber	Loads	922	2,397	·0235	918	2,386	·0343
Gunpowder	lbs.	64,000	1,408	·0138	66,500	1,460	·0285

* This mine has a great command of water-power.

In another Table I have given a similar statement, founded on a comparison with the total value of ores, which in like manner I have reduced to unity (Table XIII).

XIII.—*Analysis of Proceeds and Expenditure of the Consolidated Mines, near Redruth, and of Fowey Consols, near St. Austell, for the year* 1836.

	Gross Receipt.		Gross Receipt.
Consolidated Mines	£145,716	Fowey Consols	£97,996

Assuming the gross receipt as unity, the expenditure and profit may be expressed thus:—

	Consolidated Mines.	Fowey Consols.
Lords' dues	0·043	0·056
Agents	0·022	0·013
Tutworkmen	0·180	0·166
Surface Labour, Ores, Carriage	0·077	0·106
Carpenters, Masons, Smiths, &c.	0·021	0·016

	Consolidated Mines.	Fowey Consols.
Materials	0·103	0·146
Engine and Water-cost	0·106	..
Tributers	0·170	0·250
Sundries	0·018	0·012
Balance, profit	0·259	0·235
Small Fractions	1	..
Total	1·000	1·000

Here I have compared the total distribution of the proceeds, including landlords' dues and profits to the adventurers, together with the outlay for the various kinds of labour and materials (Table XIV).

XIV.—*Materials used in the Consolidated Mines and Fowey Consols, in* 1836.

		Consolidated.	Fowey Consols.
Coals	Tons	11,817	1,301
Candles	lbs.	113,916	72,000
Gunpowder	,,	64,000	66,500
Debenture Timber	Feet	49,091	45,928
Iron, of various sizes	Tons	108	90
Yellow Pine	Feet	2,129	1,376
American Oak	,,	..	703
Steel, of various descriptions	Cwt.	135	91
Tallow	,,	375	77
Flat and Round Ropes	,,	977	379

		Consolidated.	Fowey Consols.
192 Hides of Leather	lbs.	8,996	2,352
Patent half-inch Chain	Fms.	2,474	700
Pick and Shovel Hilts	Doz.	13,098	664
Nails, &c.	Bags	91	53
Engine Shag, &c.	Yards	3,438	700
Oil	Galls.	996	916
Safety Rods in Blasting	£	262 10 0	475 4 2
Foundry Bills for Pumps		£1,735 0 1	1,775 4 2
Books, Stationery	£	50 6 7	52 5 4

After all, however, though these Tables may be accurate as records of facts belonging to their own subject, the inferences derived from them respecting the mines generally, can be but approximations, and I have on all occasions had recourse to positive information when it could be obtained.

Now, as to the wages of 1837. I have already computed those of 1836 at 482,116*l.* But I have been told that the wages of last year were about fifteen per cent. below the rate of the year before; therefore, the wages of 1837 will, by this computation, have been about 409,700*l.* Again, in Table XV. will be found an account of the transactions of the Consolidated Mines for fourteen years; and it is there shown that the ratio of wages to ore, was, throughout the period, as 3*l.* sterling of wages to one ton of ore. Now, the ore of the county last year was 140,753 tons; the wages, therefore, were probably about three times that number of pounds, or 422,259*l.* The mean of these two sums, 409,700*l.* and 422,259*l.*, is 415,979*l.* I assume, then, that the wages of last year were about 416,000*l.* in the copper mines, and the tin and copper mines in respect of copper.

XV.—*Transactions of the Consolidated Mines for Eighteen Years.*

Years.	Capital and Compound Interest.	Cost.	Lords' Dues.	Value of Ores.	Tons of Ore.	Wages.
	£.	£.	£.	£.		£.
1819	15,267	..	..	..	..	..
1820	36,644	..	..	..	..	..
1821	18,223	..	..	..	..	..
1822	3,506	..	..	..	..	..
1823	3,479	69,836	3,478	83,488	11,532	43,716
1824	13,001	84,081	4,584	110,036	14,980	47,885
1825	2,768	95,451	4,971	119,312	13,379	53,275
1826	1,985	82,865	3,848	92,355	13,872	43,200
1827	1,726	81,322	4,108	98,601	13,637	41,439
1828	1,199	69,825	4,013	96,313	13,262	37,568
1829	340	68,177	3,673	88,171	12,578	38,183
1830	Capital repaid.	69,897	3,795	91,092	13,512	39,304
1831	. .	75,290	4,310	103,451	15,292	43,410
1832	. .	83,472	4,791	115,000	15,670	47,051
1833	. .	89,696	5,967	143,227	18,191	51,844
1834	. .	88,956	5,652	135,670	20,022	42,690
1835	. .	90,216	5,607	134,574	19,619	53,787
1836	. .	102,007	6,071	145,717	18,499	61,257
					214,045	644,699

Now, as to the number and description of persons employed. First, we have the enumeration in Tables XVI. and XVII., which, though not entirely complete, is the best criterion to which I can refer. But it includes all mines, tin and lead, as well as copper; and, as tin and copper are often wrought out of the same mine, I have not been able to distinguish the number of persons employed in each separately.

XVI.—*Enumeration of Persons in Fifty-nine Mines.*

MINES.	Men.	Women.	Children.	Total.
North Roskear . .	300	190	150	640
South Roskear . .	148	172	60	380
Binner Downs . .	250	100	40	390
Trewavas	102	42	17	161
Great St. George .	255	35	50	340
Wheal Leisure . .	68	6	21	95
Wheal Prudence . .	40	20	13	73
Wheal Virgin . . .	167	134	91	392
Wheal Buller . .	83	42	30	155
Wheal Busy . . .	34	50	28	112
Levant	320	44	186	550
Perran Consols . .	80	14	6	100
Consols and United Mines . . .	1730	869	597	3196
East Crinnis . . .	124	46	62	232
Pembroke . . .	75	12	52	139
Wheal Gorland . .	53	12	21	86
Wheal Damsel . .	28	1	11	40
Wheal Providence .	61	8	24	93
Wheal Harriette . .	21	8	4	33
Wheal Maiden . .	15	11	11	37
Unity Wood . . .	206	80	138	424
Carharrack . . .	42	34	20	96
North Downs . .	16	3	5	24
Cardrew	24	6	10	40
Fowey Consols and Lanescot . .	1057	308	315	1680
Great Work . . .	298	46	74	418
Morvah and Zennor .	86	2	28	116
Gwallon	100	16	20	136
Tredarva	8	3	5	16
St. Ives Consols . .	237	16	60	313
Wheal Reeth . . .	147	18	66	231
Balnoon	62	6	12	80
Boscaswell Downs .	182	5	59	246
Wheal Mary . . .	118	14	31	163
Stray Park . . .	137	30	22	189
Dolcoath	300	220	70	590
East Wheal Crofty .	456	404	144	1004
East Pool	111	82	18	211
Wheal Friendship .	85	19	11	115
Wheal Prosper . .	68	6	6	80
Wheal Darlington .	215	50	52	317
Rospeath	42	4	6	52
Great Wheal Fortune	165	15	27	207
Trevaskus . . .	103	30	11	144
Trevarthen Downs .	6	7	3	16
Owen Vean . . .	62	4	6	72
Penberthy Crofts .	21	3	3	27
Providence . . .	83	19	30	132
East Wheal Strawberry . . .	71	19	30	120
Holmbush . . .	145	8	38	191
St. Austell Hills . .	72	13	24	109
North Claze . . .	7	1	1	9
Rocks	74	9	12	95
Carrygian Roche .	30	1	4	35
Charlestown . . .	431	120	263	814
Polberran	362	34	82	478
Wheal Coit . . .	8	4	4	16
Polgooth	141	10	51	202
Wheal Vor . . .	592	327	255	1174
Total . 59 Mines.	10,624	3802	3490	17,916

Let us try what can be done by calculation. In the two mines so often referred to there were, in 1836, 4067 persons—2362 men, and 1705 women and boys—employed to raise 32,500 tons of ore. Table XVI. shews the result of an actual enumeration in fifty-nine mines (from all of which I have the returns complete), distinguishing the sexes.

It gives a return of 10,624 men, and 7292 women and children; these numbers relatively agreeing very closely with the above numbers employed in the two mines. I have some confidence, therefore, in the opinion, that the relative numbers of men to women and children throughout the county does not differ materially from those of the fifty-nine enumerated mines. Now, the total wages of last year having been 416,000*l.*, and the average per head having been 2*l.* 11*s.* 6*d.* for the men, and 14*s.* 6*d.* for the women, per month (*see* Tables VIII. and X.), and the relative proportion of men to women being as 10,624 to 7292, we have the terms from which to calculate the number of persons employed in 1837. The result is 19,035 persons, of whom 11,282 were men, and 7743 women and boys. This refers only to the copper mines, and the tin and copper mines in respect of copper. Tables XVI. and XVII. shew the population of the mines generally; some mines, I know, have been omitted, and perhaps it may be nearly correct to take the whole population at work to be 28,000 persons. The Tables give a total of 27,028 persons belonging to 160 mines.

XVII.—*Supplement to Table XVI.*

Mines.	Men.	Women.	Children.	Total.
Wheal Ann . . .	..	..	..	121
Wheal Andrew . .	7	..	2	9
Wheal Agar . . .	..	..	..	55
Wheal Amelia . .	4	..	..	4
Bell	..	..	..	6
Boscean	65	..	24	89
Bosorn	16	..	4	20
Baldue	5	..	1	6
Ballowall	27	..	9	36
Wheal Budnick . .	99	41	32	172
Wheal Brothers . .	2	..	..	2
Wheal Bolton . .	64	6	..	70
Wheal Barnes . .	..	..	..	22
South Wheal Bassett	..	..	..	230
East Wheal Bassett .	..	..	..	100
Cornwall Great United	155	20	22	197
Carclaze	8	..	6	14
Carn Brea . . .	517	137	69	723
Camborn Consols .	4	..	..	4
Copper Valley . .	4	..	1	5
Copper Bottom . .	43	21	8	72
Cook's Kitchen . .	..	..	..	247
Wheal Clinton . .	4	..	1	5
Wheal Curtis . .	..	..	..	60
Wheal Change (Lanevit) . .	..	..	..	40
Wheal Charles . .	..	..	..	10
Wheal Clarence . .	..	..	..	10
West Cliff Down .	..	..	..	6
East Cornwall . .	6	..	..	6
Creigbraws . . .	26	5	10	41
West Dolcoath . .	4	..	1	5
East Downs . . .	6	..	2	8
Wheal Ellen . . .	..	..	..	220
Wheal Fire . . .	6	..	..	6
Wheal Friendship .	4	..	..	4
Wheal Fancy . . .	..	..	..	8
Friendly	8	2	2	12
Gunnis Lake . . .	62	7	19	88
Godolphin . . .	370	70	40	480
Glebe	2	..	2	4
Gurnett's Head . .	24	..	..	24
Wheal Gray . . .	..	..	..	130
Hallamaning and Retallack . .	..	..	..	10
Hallenbeagle . .	122	20	50	192
North Hallenbeagle .	30	6	4	40
Wheal Julia . . .	100	26	22	148
Wheal Jewel . . .	212	53	94	359
West Wheal Jewel .	79	10	35	124
Wheal Kitty . . .	118	52	88	258
Levant Consols . .	..	..	..	20
Wheal Martha . .	26	10	4	40
Wheal Mary & Parent	..	..	..	30
Wheal Maitland . .	20	..	6	26
Wheal Millpool . .	..	..	..	20
South Wheal Mary .	11	..	3	14
Marazion Mines . .	222	83	96	401
Wheal Neptune . .	4	..	..	4
Wheal Owles . . .	110	..	21	131
Wheal Osborne . .	40	6	6	52
Wheal Prosper . .	10	..	4	14
Wheal Pye . . .	3	2	1	6
South Polgooth . .	92	14	20	126
Perran Downs . .	41	..	..	41
Pentuan Stream . .	18	..	5	23
Phœnix (Padstow) .	13	..	1	14
Polbreen	80	..	..	80
West Poldice . . .	..	..	..	30
Relistian	138	67	45	250
Redmoor Consols .	110	16	25	151
Wheal Rome . . .	..	..	..	8
Wheal Rose . . .	4	..	..	4
South Rose . . .	29	..	12	41
Spearne	..	..	..	70
Streamers (Camon) .	144	2	66	212
Wheal Speed . . .	10	..	..	10
Wheal St. Just . .	2	..	..	2
Wheal Sarah . . .	12	..	..	12
Wheal Sparrow . .	..	..	..	31
Wheal Seaton . .	..	..	..	50
Wheal Sisters . .	..	..	..	4
Tresavean . . .	..	..	..	1354
North Tresavean .	..	..	..	..
Trevenen	..	..	..	30
Trethellan . . .	..	..	..	77
Tresavara	25	8	..	33
Turnavoore . . .	4	..	1	5
Trebilzue	19	..	..	19
Tincroft Consols . .	..	..	..	309
East Tincroft . . .	..	..	..	4
West Tincroft Consols	33	..	4	37
North Towan . . .	..	..	..	20
Wheal Triumph . .	10	..	2	12
Wheal Treasure . .	5	..	3	8
Wheal Trumpet . .	..	..	..	60
Wheal Trenwith . .	83	6	20	109
Wheal Trevannance	12	..	..	12
Wheal Tamar and South Hooe .	83	6	21	110
West Wheal Tamar .	..	..	..	45
United Hills . . .	269	90	..	359
Wheal Uny . . .	..	..	..	146
Wheal Vyvyan . .	54	25	24	103
Total . 160 Mines.	..	..	..	27,028

Before quitting this subject, I will just notice that during the same fourteen years alluded to, the total ores of the county were 1,796,198 tons, or 128,300 tons per annum on the average; therefore the average annual wages will have been 384,900*l.*

Héron de Villefosse, whose book was published in 1819, but whose information respecting Cornwall seems to have been gathered some years earlier, says that the labourers in all the mines of the county were about 14,000, and with their families comprehended a population of 60,000 persons. The return for the miners' militia, raised exclusively from the mines, might at that time be appealed to: but as he gives no authority for his estimate, it rests at present on his own conjecture. He estimates the capital engaged in the mines at 350,000*l.* I have no means of estimating the total capital employed at present; but the outlay and repayment of capital in the Consolidated Mines will be found in Table XV.

I have now only a few desultory remarks to make on subjects which have not found a place in the preceding observations. The speed of sinking in mines varies greatly according to the local circumstances, the nature of the work, and the quality of the rock. Thus, in Wheal Reeth, only twenty fathoms were sunk from 1828 to 1834, or between three and four fathoms per annum. This was from the 160 to the 180 fathom level below the adit, and in granite. In the Levant mine, from 1830 to 1837, ninety fathoms were sunk; at the rate of thirteen fathoms per annum. This was from the 110 to the 200 fathom level, and in greenstone. In East Wheal Crofty, from 1833 to 1837, seventy-seven fathoms were sunk, from the 43 to the 100 fathom level; at the rate of fourteen fathoms per annum. This was also in greenstone.

Héron de Villefosse computes the consumption of coal at the mines at about 60,000 tons; and I think he must have been near the truth. Mr. Carne calculates that in 1834 the total consumption of coal by all the engines, of every description, was 69,559 tons. Thus, if the engines now in use were not more efficient than those of 1814 (about the time when Héron de Villefosse wrote), the work now done would require 168,745 tons of coal; so that there is a saving of 99,186 tons, which at 17*s.* per ton (including carriage), is equal to 84,000*l.* per annum.

Table XIX. shews the total consumption of coal by the reported engines in the year 1837.

XIX.—*Coals Consumed by the Engines reported by Captain Lean's Duty Paper.*

Months. 1837.	Drawing Water.		Stamping and Drawing Ores.	
	No. of Engines.	Bushels of Coal consumed.	No. of Engines.	Bushels of Coal consumed.
January . .	60	98,075	19	8,453
February . .	62	115,399	21	10,081
March . . .	62	114,690	21	10,571
April . . .	60	102,775	20	10,943
May . . .	61	82,176	18	9,474
June . . .	60	92,994	19	10,340
July . . .	60	84,791	19	8,475
August . . .	59	81,273	17	8,227
September .	59	87,517	17	8.150
October . .	57	76,227	17	7,711
November . .	55	78,551	16	8,085
December . .	55	79,546	17	9,499
Total . .	710	1,094,015	221	108,019
		108,019		
Average .	60		18	
	18	1,202,034		
Total Engines	78			

1,202,034 Bushels of Coals, weighing 93 lbs. per Bushel, are equal to 49,906 Tons.

	Engines.	Coals Consumed.
Brought down . . .	78	49,906 tons.
Second Duty Paper . .	11	6,954
Average No. of Engines	89	56,860

Table XX. exhibits the water discharged by the same engines in the same year.

XX.—*Water Discharged in* 1837 *by the Engines reported in the Duty Paper.*

Months.	No. of Engines.	Galls. per Min.	Months.	No. of Engines.	Galls. per Min.
January . .	62	17,143	August . .	59	13,866
February .	63	18,915	September .	59	13,221
March . .	64	17,588	October . .	57	12,188
April. . .	58	15,605	November .	57	12,299
May . . .	62	15,422	December .	56	12,891
June . . .	60	15,152			
July . . .	60	14,634		Total . .	178,924=31,141,800 { tons for the year 1837.

By Second Duty Paper, 11 Engines . . 5,758,912 tons.

Total . . . . 36,900,712 tons.

It is a matter of some interest to ascertain the average age of the Norwegian timber used in the mines; and the rings, marking the annual growth, have been counted in what appeared to be ten average trees. They exhibited rings, 140, 114, 120, 100, 60, 121, 98, 120, 140, 162, averaging 117·5 rings. Six other trees averaged 124 rings. The general average may be taken at 120 years' growth. Now, the consumption of 1836 was 36,207 loads of timber, which, at four trees to a load, is equal to 144,828 trees. If these trees grew fifteen feet apart, they would cover 750 acres of ground; and if they were 120 years old, it would require the produce of 140 square miles of Norwegian forest to supply the mines of Cornwall. It must be remembered, however, that the consumption of 1836 was unusually large.

Table XXI. shews the number of loads, price, and value of debenture timber from 1818 to the present time.

XXI.—*Debenture Timber.*

Years.	Loads.	Price. Shillings.	Value. Carriage Included	Years.	Loads.	Price. Shillings.	Value. Carriage Included.
1818	5,726	107	£30,634	1828	16,170	61	£49,318
1819	9,240	78	36,036	1829	17,321	57	49,364
1820	10,700	74	39,590	1830	14,506	57	41,339
1821	9,723	66	32,085	1831	16,206	52	42,291
1822	8,419	62	26,098	1832	17,341	47	40,751
1823	13,072	70	45,752	1833	18,282	47	42,962
1824	15,855	70	55,492	1834	19,595	52	50,947
1825	21,732	70	76,062	1835	24,832	52	64,563
1826	12,305	66	40,606	1836	36,207	52	94,138
1827	11,687	61	35,643	1837	14,056	52	36,545

50 cubic feet = a load—on the average contained in four trees. Thus the consumption of 1836 was 36,200 loads, × 4 = 144,800 trees.

The annual consumption of gunpowder is about 300 tons (2000 lbs. in each). The price in 1836 was 44*l*. per ton; and the value consumed per annum about 13,200*l*.

On the subject of vital statistics I have little to add to a paper which was laid before the Society by Colonel Sykes; but I have been furnished by Mr. Blee, of Redruth, with the facts which will be found in Table XXII., tending to shew the proportion of deaths from mine accidents and from diseases of the chest (to which miners are especially liable), compared with deaths from other causes, in three of the largest mining parishes of the county.

XXII.—*Male Deaths, between the Ages of Ten and Sixty, in the three great Mining Parishes.*

Population in 1831.
Gwennap, 8,539; Redruth, 8,191; Illogan, 6,072—Total, 22,802.

Ages.	Gwennap, 18 Months, to Jan. 1837.			Redruth. 7 Years.			Illogan. 5 Years, to July, 1835.			Total.		
	Mine Accidents.	Diseases of Chest.	Other Causes.	Mine Accidents.	Diseases of Chest.	Other Causes.	Mine Accidents.	Diseases of Chest.	Other Causes.	Mine Accidents.	Diseases of Chest.	Other Causes.
From 10 to 20 .	3	5	12	7	3	13	5	8	14	15	16	39
„ 20 „ 30 .	5	10	11	3	13	11	4	24	15	12	47	37
„ 30 „ 40 .	2	4	8	2	16	14	7	11	7	11	31	29
„ 40 „ 50 .	6	18	6	3	39	11	3	23	7	12	80	24
„ 50 „ 60 .	1	17	6	1	30	13	..	21	10	2	68	29
Total . .	17	54	43	16	101	62	19	87	53	52	242	158
	114			179			159			452		

I have taken the comparison only between the ages of 10 and 60, because few persons are found working in the mines out of these limits. It is dreadful to see how large has been the sacrifice of life from causes which are susceptible of alleviation, if not of remedy; the mine accidents proceeding chiefly from the blasting of rocks by gunpowder, and the diseases of the chest arising almost entirely from the effort of ascending from the greatest depths with exhausted strength; (the Consolidated Mines are above 300 fathoms deep from the surface). Both these evils, I hope, are in the course of being removed; the first by the use of a wedge, the invention of Mr. W. R. Fox, which will supersede the dangerous necessity of tamping with broken stone; and the second, by the application of machinery to raise the men from their work. The deaths from these two causes are, to the deaths from all other causes, between the ages of 10 and 60, as 294 to 158.

With respect to education, I will only observe, that the miners are fond of instruction, and are educated in their different grades far beyond the average of most other counties, but they possess no especial opportunities. I know of only one school on a mine particularly for the benefit of those there employed; it was established by the late Mr. Borlase, who was a member of this Society. About 100 scholars attend it, and the advantage to the mine and neighbourhood is said to be immense. It is at Wheal Vor, near Helston.

Table XXIII. exhibits a rough estimate of the total mineral wealth of the kingdom, and shews the proportion of it occupied by copper. I give it on the authority of Mr. English, editor of the *Mining Journal.*

XXIII.—*Estimate of the Mineral Produce of Great Britain, on an Average of Years and Prices.*

	Quantity.	Value. £.		Quantity.	Value. £.
Silver	10,000 lbs. Troy	30,000	Coal	25,000,000 tons	10,000,000
Copper	13,000 tons	1,300,000	Salt, Alum, and other minor Produce more than		1,000,000
Tin	5,500 tons	550,000			
Lead	46,000 tons	950,000			
Iron	900,000 tons	7,000,000	Total Value probably exceeds		£20,000,000

Tables XXIV. and XXV. shew the amount of British copper exported; the foreign copper ore smelted under bond, and the rate per cent. of such ore.

XXIV.—*British Copper Exported—Wrought and Unwrought.*

Years.	Tons.	Years.	Tons.	Years.	Tons.	Years.	Tons.
1796	4,572	1802	6,348	1808	3,028	1814	3,035
1797	3,852	1803	4,554	1809	3,458	1815	5,099
1798	3,930	1804	2,935	1810	2,902	1816	5,207
1799	4,858	1805	3,007	1811	2,413	1817	6,647
1800	4,847	1806	2,343	1812	3,334	1818	6,077
1801	4,825	1807	3,374	1813	..	1819	4,824

XXV.—*British Copper Ore Exported, distinguishing Unwrought and Wrought; Foreign Ore Imported; Copper Smelted therefrom and Exported; the Rate per cent. of Metal Exported to the Ore Imported.*

Years.	British Copper Exported.			Foreign Copper Imported.	Exported, Smelted from Foreign Ore.	Produce per cent. of Ore (computed from Metal Exported.)
	Un-wrought.	Wrought.	Total.			
	Tons.	Tons.	Tons.	Tons.	Tons.	
1820	2057·7	4010	6097·9	..	..	..
1821	1727	4544	6271·5	..	..	..
1822	1291	4492	5683·5	..	..	..
1823	1204	4121·6	5325·8	..	..	..
1824	960	4344	5304·8	..	..	..
1825	·5	3930·6	3931	..	..	..
1826	130·2	4669·4	4799·7	64·8	..	..
1827	1329	5841	7171	32·9	..	..
1828	1079·5	5126·5	6206	334·6	7	Five Years. 13·2
1829	2648·9	5327	7976	1212·9	33·6	
1830	2986	6171·5	9157·7	1436·6	164·1	
1831	3360	5170·6	8530·6	2545 9	354·4	
1832	3874·8	5855·7	9730·6	3955·7	694·7	
1833	2894·3	5417·2	7811·6	5931·6	1624·6	Five Years. 19·5
1834	4098 9	4787·5	8886·5	6987	1185·7	
1835	3162·6	5940·6	9111·2	13945	2772·8	
1836	1970·4	6105·8	8076·2	18419	1939	
1837	1673·6	5455·6	7129·3	19465·8	5155·2	

N.B.—No return is made of the metal obtained from foreign ores, and the produce per cent. can be estimated only by reference to the copper exported. For this purpose it is necessary to take groups of years, and I have taken two. The first, comprehending five years, from 1828 to 1832 inclusive, giving a produce of 13·2; and the second, of five years, from 1833 to 1837 inclusive, giving a produce of 19·5. The produce of the whole period is 18·7. But as the ore exported in each year is, in some measure, smelted from the importation of the year before, I have compared the exports of ten years, ending with the close of the year 1837, with the imports of ten years, ending with the close of 1836, and this comparison gives a produce of 25·5. This, probably, somewhat exceeds the real rate of produce, but not to any great extent, as will be seen by the following Table:—

Average Produce by Assay of all the Foreign Ores Imported at Swansea and Liverpool, from 1827 *to May* 1833.

SWANSEA.		LIVERPOOL.	
From South America	23⅝	From South America	28¾
„ United States	23⅞		
„ Norway	8¾		

In concluding this Paper, I have only to offer my best thanks to the Mine-Agents and others who have very readily given me their assistance in collecting information. I particularise none, because they are so numerous; but I must not omit to acknowledge especially my obligations to persons connected with the Consolidated Mines and Fowey Consols, for communications almost of a confidential character, which have formed the basis of my calculations. The sketch I here offer is slight, and some of the Tables are avowedly imperfect; but they will shortly be replaced by the results of an enquiry taken up at the suggestion of the British Association, and now in the hands of a person having far better opportunities than I possess of obtaining information. His Report will comprehend all the mines, of whatever description: I have confined myself to those of Copper.

JOINT-STOCK COMPANIES IN FRANCE.

The French Code of Commerce recognizes three kinds of Commercial Societies for purposes of a permanent nature;—viz., 1st, Societies "en nom Collectif," or Common Partnerships; 2d, Societies "en Commandite," or Firms with Sleeping Partners; and 3d, Anonymous Societies, or Joint-Stock Companies.

The first consists of a certain number of persons associated in a firm, in which their several names are included. Each partner is responsible for the whole, and there is no limit to his liability.

Societies "en commandite" consist of several individuals, one or more of whom are alone responsible for the acts of the firm, and are liable to the whole extent of their property. Others, who embark a fixed amount of capital in the enterprise, and are called "commanditaires," or sleeping partners, take no share in the business of the society: their names do not appear in the firm, and they are responsible only to the extent of their registered investment. The law allows this sum to be divided into transferable shares.

The third class, or Anonymous Societies, resemble Joint-Stock Companies in this country. The capital is divided into shares, and each holder is liable only to the amount of those which he possesses. The business is carried on by a few individuals elected by the shareholders, who are not personally responsible to the public.

In a recent Report of a Committee of the French Chambers the following statement is given of the number of Companies of the two latter classes established in France, and registered in the Tribunal of Commerce at Paris, from the year 1826 to the close of 1837:—

	Number.	Capital. Fr.		Capital. £.
Societies "en Commandite" .	1106	1,117,098,740	=	44,683,948
Joint-Stock Companies . . .	157	393,396,125	=	15,735,844

The average nominal capital of the first class is 40,000*l.*, and that of the latter 100,000*l.*

With respect, however, to the above figures, it must be borne in mind that a considerable number of the Companies never commenced